

Abstract Title Page

Title:

The Benefits of Being a Big Fish: The Relationship between Incoming Rank and Student Outcomes

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Abstract Body

Background / Context:

In an era of expansive school choice, families and students make many comparisons when they consider schools. Policies encourage families to seek out options where average test scores are high or where value-added indicators are strong. When students choose schools with high-performing peers, they often may be at a lower place in the achievement distribution in their cohort than if they had attended their neighborhood school. This tradeoff between higher-quality peers and one's own place in the distribution of students at a school is one that families may need to consider, particularly if there are negative effects to having a lower incoming rank.

Incoming rank could translate into different high school experiences for students through two primary mechanisms. First, schools could treat students differently based on their relative academic performance compared to their classmates because grade 8 test scores are one of the only pieces of information that a high school has about incoming students. Higher-ranked students, might have access to better teachers or more rigorous coursework or higher-achieving peers; thereby resulting in a high school experience that might better prepare students for college and employment – particularly if a high school tracks students based on achievement. The literature on tracking and peer effects generally agrees that students benefit from interacting with high-achieving peers (Betts and Shkolnik, 2000; Duflo, Dupas, and Kramer, 2011; Hoxby, 2000; Nomi and Allensworth, 2013; Sacerdote, 2001). Further research on tracking and sorting by ability has shown that students' grades and pass rates tend to be lower in classrooms with high-achieving peers, compared to students with similar test scores in classrooms with lower-achieving peers (Farkas, Sheehan, & Grobe, 1990; Kelly, 2008; Nomi & Allensworth, 2009). It makes sense, then, that student outcomes would be influenced by incoming class rank if the high school uses that information to make programming and curricular decisions.

In addition to differential treatment by school staff, students might react to their ranking by putting in more effort if they feel they are perceived to be top students. That is, there might be psychological benefits to students based on their ranking. Students' class rank could affect their subsequent achievement both by affecting their mindsets about themselves as learners, and by affecting the ways in which they are treated within their school by the school staff. There is in fact, some evidence to suggest that students' academic skill levels relative to their peers could influence their subsequent achievement. Several studies have found that students who just make the cut-off into selective schools can feel marginalized in schools with higher-achieving peers, controlling for their own achievement (Marsh & Hau, 2003; Pop-Eleches & Urquiola, 2013).

Purpose / Objective / Research Question / Focus of Study:

The purpose of this study is to understand how a student's place in the achievement distribution of incoming ninth graders affects his/her outcomes. If high schools assign students to classes or tracks based on prior test scores, then students might have very different high school experiences based on their own achievement but also the achievement level of their ninth-grade peers. We also show that a student's incoming achievement rank depends heavily on his/her school choice – where the same ability student might have a much higher or lower incoming rank at different schools.

While much of the prior literature focuses on the benefits of attending high-performing high schools or the benefits of being around high-achieving peers, this study is the first to our knowledge that aims to establish the effects of incoming class rank on student outcomes. We add to the current research by controlling for a robust measure of academic ability that combine information across multiple measures and by controlling for the high school a student chooses to attend. Both of these factors are endogenous to class rank, so we must account for them explicitly in our estimation strategy. In this paper, we specifically answer the following questions:

1. What is the relationship between a student's place in the achievement distribution of his/her high school cohort of ninth graders (i.e., incoming class rank) and high school and college academic outcomes?
2. Does the effect of incoming class rank vary for different types of students? At schools with varying levels of performance?

Setting:

The research in this proposal is conducted in Chicago Public Schools, specifically non-charter high schools.

Population / Participants / Subjects:

This study uses data on four cohorts of students enrolling as first-time ninth graders in Chicago public high schools from fall 2008 to fall 2011, totaling 72,613 students. The sample is limited to students who attended CPS in eighth grade and enrolled in CPS for ninth grade. We make this sample because in order to construct the incoming class rank variable, we need an indicator of 8th grade achievement on standardized tests. The sample represents between 75 and 79 percent of the first-time ninth-graders, depending on the cohort. When comparing all ninth-graders to the analytic sample, there are no significant differences in observable characteristics between the two groups of students. Table 1 describes the students in the analytic sample. The sample is 41 percent African American and 45 percent Latino. Most students in the sample qualify for free/reduced-price lunch (84 percent), and 14 percent of them have special education status and 7 percent are identified as having limited English proficiency. Their standardized test score at the beginning of grade 9 was an average of 14.5 compared to a national average of 16.1¹, and the average GPA in grade 8 was around a 2.5. School choice, as we discussed, is an important piece of context for this study, and 68 percent of the sample attended their assigned elementary school compared to only 43 percent attending their assigned high school.

Intervention / Program / Practice:

The specific treatment we are interested in is the effect of a student's incoming class rank in ninth grade on his/her later academic outcomes. We calculate an individual student's incoming rank as his/her percentile among all students in his/her ninth-grade cohort based on performance on the eighth-grade standardized test (the Illinois Standards Achievement Test, or ISAT). For the

¹ See technical manual for more information about the EXPLORE.
<http://www.successlineinc.com/ACTInfo/EXPLORETechManual.pdf>

cohorts in the analytic sample, the ISAT was administered to all students in Illinois in grades 3-8 in the spring of the school year, usually in March or April. At each high school, then, there is a uniform distribution of incoming grade 9 students, ordered from highest performers (at the 99th percentile) to lowest performers (at the 1st percentile).

Research Design:

The variable of interest, incoming class rank, is influenced by two factors: 1) the student's performance on the grade 8 standardized test, and 2) the student's high school choice and the incoming performance of his/her peers at that high school. Making decisions based on a single test score can be problematic, as the test score is a noisy measure of ability and test scores can fluctuate over time. Considering school accountability decisions that are based on test score performance in a single year, Kane and Staiger (2002) warn that school-level performance is bound to vary from year to year, suggesting that policies should focus on multiple years of data and trends in performance rather than snapshots. They also point out that the schools with the absolute best and worst performance on tests are the most likely to be subject to volatility of this sort. This same principal can apply to students – student test scores in a single year can be subject to random fluctuation. However, high schools that have limited information about incoming students only know how students performed on a single exam, their 8th-grade standardized test. Schools may use that information to assign students to various classes (i.e., track students based on past performance), and, as such, higher-scoring students may have access to higher-quality teachers, course content, and peers. For this reason, and because incoming class rank and prior achievement in 8th grade are collinear, we construct a measure of underlying ability that relies on multiple pieces of information about the student's past academic performance.

We standardize five measures of academic achievement – a test score measure that uses all prior test score information about the student (from as early as third grade), and GPA, attendance rates, and the number of suspensions all from grade 8. We also bring in student self-reports of study habits in grade 7 or grade 8 (depending on the year students were surveyed). Using this information, we conducted a principal component analysis. The first component accounted for 42 percent of the shared variance of the prior measures of academic performance.

We directly account for the main potential sources of endogeneity – student underlying ability and school choice – with an estimating equation that accounts for student ability above and beyond the variable used to create incoming class rank as well as school fixed effects. Ultimately, we are estimating the effect of incoming rank on student outcomes, comparing students of similar underlying ability who attend the same high school, as shown in equation (1).

$$(1) \quad Y_{isc} = \alpha + \delta Rank_{isc} + \mathbf{Ability}_i' \boldsymbol{\gamma} + \mathbf{X}_i' \boldsymbol{\beta} + \phi_s + \phi_c + \varepsilon_{ics}$$

where Y is the outcome of interest for student i , in high school s , in cohort c . The student's incoming class rank is indicated as $Rank_{isc}$, which is a uniform variable for each school and is coded between 0 (the lowest-ranked student) and 1 (the highest-ranked student). The ability vector includes a linear and square term of the standardized first component from the principal component analysis (described in detail previously). We include a number of student controls – race/ethnicity, gender, special education status, and an index of neighborhood poverty at the

Census block level of the student's home address. All specifications shown include cohort fixed effects. The preferred specification shown in Equation (1) also includes high school fixed effects. We include robustness and sensitivity tests as well.

Data Collection and Analysis:

In this paper, we use administrative data from CPS, a survey measure of student self-reports of study habits in middle school, and college-going information from the National Student Clearinghouse (NSC). Student data are linked across administrative data sets and years using a unique student-level identifier. We observe the school that a student attends at two points during the year, and we also know the student's assigned school, which may be different than the school of record. We also have extensive demographic information about the student – race/ethnicity, gender, age, free/reduced-price lunch eligibility, special education status, and limited English proficiency status. In addition, we know the home address, which is linked to more detailed poverty and social status information from the 2000 Census.

We include academic outcomes from high school and college-going outcomes. High school outcomes include GPA in grades 9 and 11 – grade 9 GPA is highly predictive of graduation, and grade 11 GPA is used for college applications. Attendance rates in grade 9, also predictive of high school graduation, are included. We also examine performance on standardized exams. CPS high school students take the ACT's Educational Planning and Assessment System (EPAS), which includes the PLAN at the beginning of grade 10 and culminates in the administration of the ACT in grade 11. For two cohorts of students, we are able to examine college enrollment using NSC data available for all graduates of CPS.

We use quantitative methods, including principal component analysis to identify a latent measure of student ability. We also employ econometric techniques, including school fixed effects regression models, to identify the effect of incoming rank on student outcomes.

Findings / Results:

Our results of the relationship between class rank and student outcomes is shown in Table 2. We present estimates in columns (I) and (II) that control for various student characteristics, though our preferred specification is shown in column (III). The estimates in column (III) include student demographic information, the latent ability measure (and its square term), as well as school fixed effects. This is our preferred specification as it controls for two endogenous factors – the student's academic ability and the student's school choice – which we know affect both class rank and student outcomes. We look at a variety of student academic outcomes, including academic success during high school (tests, grades, and graduation) and college outcomes (enrollment and persistence). When interpreting the results, the coefficients shown are for a student who goes from the very bottom of his/her class to the very top of his/her class. A jump of this magnitude is unlikely to occur, so it may be more reasonable to multiply the coefficients by 0.28, which is a standard deviation of the class rank variable.

In column (III), we show mixed results. Specifically, students benefit largely in terms of test scores – the effect of moving up a standard deviation in class rank is about 2 points on the ACT with smaller effects on GPA (an additional 0.05 points). With school fixed effects included in the model, it is perhaps not so surprising to see minimal effects on GPA, especially if grades are

partially based on where a student is in a distribution compared to other students in the class or school. In these results, we have taken out those school effects. Positive, and large, test score effects suggest that how a school treats a student who is higher in the achievement distribution results in more learning, or at least in better performance on tests. Note that the test is a standard measure across schools, so including school fixed effects might account for the fact that some schools are better at test preparation than others. We find negative effects for attendance and graduation, and we know that attendance is a strong predictor of graduation, so we may expect those coefficients to move in the same direction. However, college enrollment and persistent seem to be positively related to class rank. We present results from the instrumental variable strategy – using the class rank in the student’s assigned high school as an instrument for the student’s class rank in his/her actual high school – in column (IV). Across the board, the instrumental variable results are very similar to the results shown in column (III), which provides additional support in the robustness of the estimates.

Conclusions:

In this paper, we look at the effects of incoming class rank on academic outcomes, after accounting for latent ability and school choice. Being at the top of your class appears to have benefits in terms of test score gains and slightly higher grades, as well as a higher likelihood of enrolling in and persisting in college. There were small negative attendance and high school graduation effects.

Future research is needed to unpack the mechanisms behind the mostly positive effects of having a higher incoming rank. Is it that schools treat students differently if they are at the top or bottom of their class? Are there psychological benefits to being perceived as a big fish? Or is it some combination of the two theories? We can speculate based on the results presented in this paper. While we find very large test score effects of having a high class rank, there are relatively small positive effects on grades. In the extreme case where test scores represent true learning and grades are a measure of effort, turning in assignments, and attendance, perhaps high-ranked students do get access to better educational opportunities within schools and that translates into a better understanding of content as measured by tests. This paper provides some evidence that schools may do a better job of preparing students academically who are higher in the distribution.

This paper also provides some insights about the tradeoffs that families and students face in a world of immense school choice. In some schools a student will be higher ranked than in other schools; and some schools may be of better quality than others, they may serve higher-achieving peers or have higher-quality instruction. Only students at the very top of the overall distribution of test scores across all schools will always be at the top of their class. Empirically, we show that in Chicago, high-achieving students are often selecting into schools that are perceived to be of higher quality, but in doing so they are at a lower place in the achievement distribution compared to their peers. Families and students may want to consider going to their neighborhood school if opting out is too much of a reach academically given their prior performance.

Appendices

Appendix A. References

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Appendix B. Tables and Figures

Table 1. Descriptive statistics of the analytic sample

Student Characteristic	Mean (s.d.)
Black	0.41
Hispanic	0.45
White	0.09
Asian	0.04
Male	0.50
Free/reduced-price lunch	0.84
Special education	0.14
Limited English proficiency	0.07
Retained before entering HS	0.21
Explore score	14.5 (3.25)
8th grade GPA	2.56 (0.83)
8th grade attendance rate	94.7 (5.88)
Attended assigned HS	0.43
Attended assigned ES	0.68
<i>Sample Size</i>	72,613

Note. To be included in the analytic sample, students must have been enrolled in grade 8 and grade 9 in CPS in order to have pre-high school information on academic performance. This includes first-time ninth graders in the fall of 2008, 2009, 2010, and 2011. Students must have attended elementary school in a non-charter CPS school, as charter schools do not report grades, attendance, or behavioral information to the district.

Table 2. Relationship between class rank and student outcomes

Outcome	Outcome Mean (s.d.)	(I) Demographics	(II) Demographics and Ability	(III) Demog., Ability, and School Effects	(IV) Class Rank IV
PLAN	15.82 (3.40)	4.13 (0.18)	1.89 (0.14)	4.33 (0.07)	4.80 (0.08)
ACT	17.96 (4.65)	5.74 (0.36)	2.87 (0.26)	6.40 (0.17)	7.29 (0.15)
GPA (Grade 9)	2.06 (1.07)	1.15 (0.05)	0.43 (0.03)	0.10 (0.02)	0.03 (0.03)
GPA (Grade 11)	2.16 (1.03)	0.91 (0.04)	0.35 (0.02)	0.18 (0.02)	0.16 (0.03)
Attendance (Grade 9)	0.86 (0.17)	0.04 (0.005)	-0.07 (0.004)	-0.07 (0.003)	-0.08 (0.004)
Graduate HS	0.77 (0.42)	0.22 (0.02)	0.01 (0.01)	-0.05 (0.01)	-0.06 (0.01)
Enroll in college	0.46 (0.42)	0.26 (0.03)	0.04 (0.01)	0.08 (0.01)	0.10 (0.02)
Persist in college	0.21 (0.41)	0.22 (0.04)	0.02 (0.02)	0.11 (0.02)	0.12 (0.02)

Notes. Columns (I) – (IV) show estimated coefficients and standard errors in parentheses. Class rank is scaled from 0 to 1 with 1 being the highest. The mean (s.d.) of class rank is 0.49 (0.28). Demographic controls include race/ethnicity, gender, special education status, and an index of neighborhood poverty (at the Census block level). Outcomes are used in their natural units. All models include cohort fixed effects, and columns (III) and (IV) include grade 9 school fixed effects. Standard errors are clustered at the grade 9 school by cohort level.